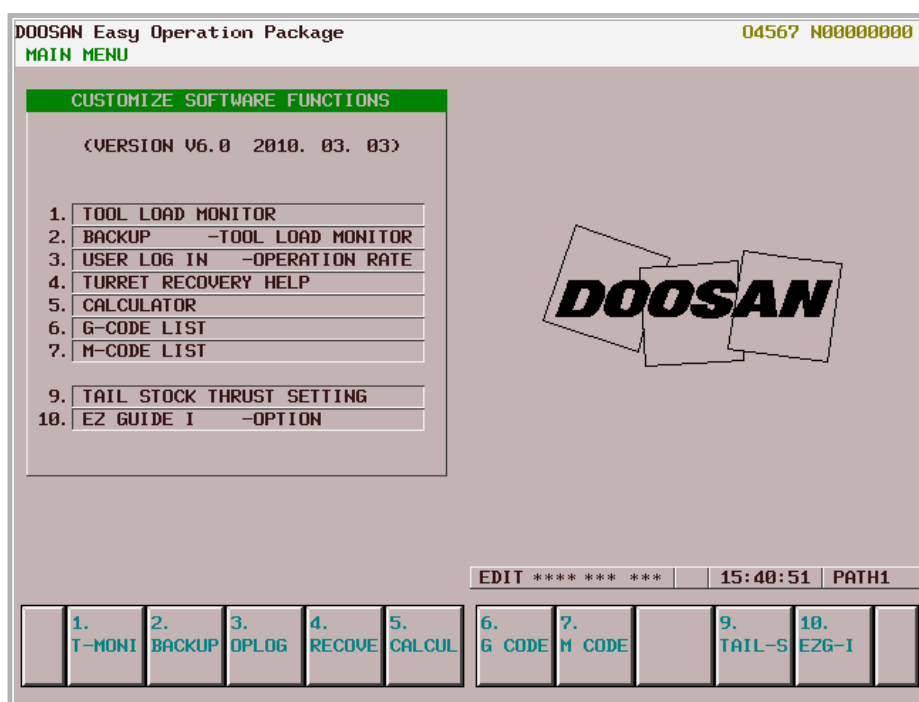# *Operation Manual*

TC Software Pack

Revision 1

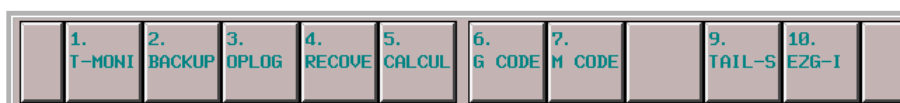# TC SOFTWARE PACKAGE OUTLINE

■ INTRODUCTION

This manual is about TC Software Package. That is applied to our specification.

Developed Package Software functions for user convenience features are as follows.

■ MAIN MENU

At the bottom of the Soft Key

Operation order
1. Press [CUSTOM] button of MDI Panel then the above window is opened
2. Press the below Soft key switches to the function window.

Note

1. Our TOOL LOAD MONITOR is option specification.
2. Our EZ-GUIDE-I is option specification. To operate the EZ-GUIDE-I, see the separate manual.

1. Tool Load Monitor

1.1 Introduction

This document is the Operation Manual for DTMT (Doosan Tool load Monitor for Turning center) Version 6.x, under-load detect version. It effects on all Doosan FANUC - 0ITD ,32i Turing Center with this STANDARD.

DTMT (Doosan Tool load Monitor for Turning center) protects Tool and Tool Holder from the further damage. If DTMT detect the abnormal load during the cutting process, machine will stop immediately or escape from cutting condition and stop by the level of abnormal load.

In the normal operation, it sets workload range from Min to Max for each Servo Drive (MAIN SPINDLE, X, Z, Y, C, M, C2, and SUB SPINDLE) of each tools. If DTMT detects a certain value of off-range, it will generate PMC ALARM.

If tool draws only small load such as small drill and taps, even though tool has been broke, it may be still within normal load range which case DTMT cannot detect this situation.

In the normal operation, when an abnormal load occur at the out of range of Min and Max load, if load is detected out of range, which was preset as minimum and maximum, during the operation, DTMT will escape the tool from cutting condition by the tool skip function, if the load detected in WARN LIMIT, and Machine will be stopped(Feed Hold Condition), if Load detected is over Break Limit.

*TOOL SKIP is FANUC TOOL LIFE MANAGEMENT OPTION,

Followings are additional or modified figures of DTMT VERSION 6.x

(1) At abnormal Tool condition, it operates at not only OVERLOAD condition but also UNDERLOAD condition.

(2) It detects in Feed mode only.

(3) Even in the normal cutting condition, Air-Cutting period could be occurred as tool approach or escape from part, to prohibit this errors, APPROACH TIME, ESCAPE TIME function has been added.

(4) Even, in the normal condition like POCKET cutting with life tooling, it is possible that no-load, or over-load can happen, to prevent this kind of problem, addition M CODE has been added to bypass DTMT load detection in certain block.

1.2 Basic Operation
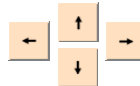
Useful Definition which you need to know.

① [key-name] ; It stands for FANUC MDI KEY (POS,PROG,RESET,DELETE,ALTER ,etc).

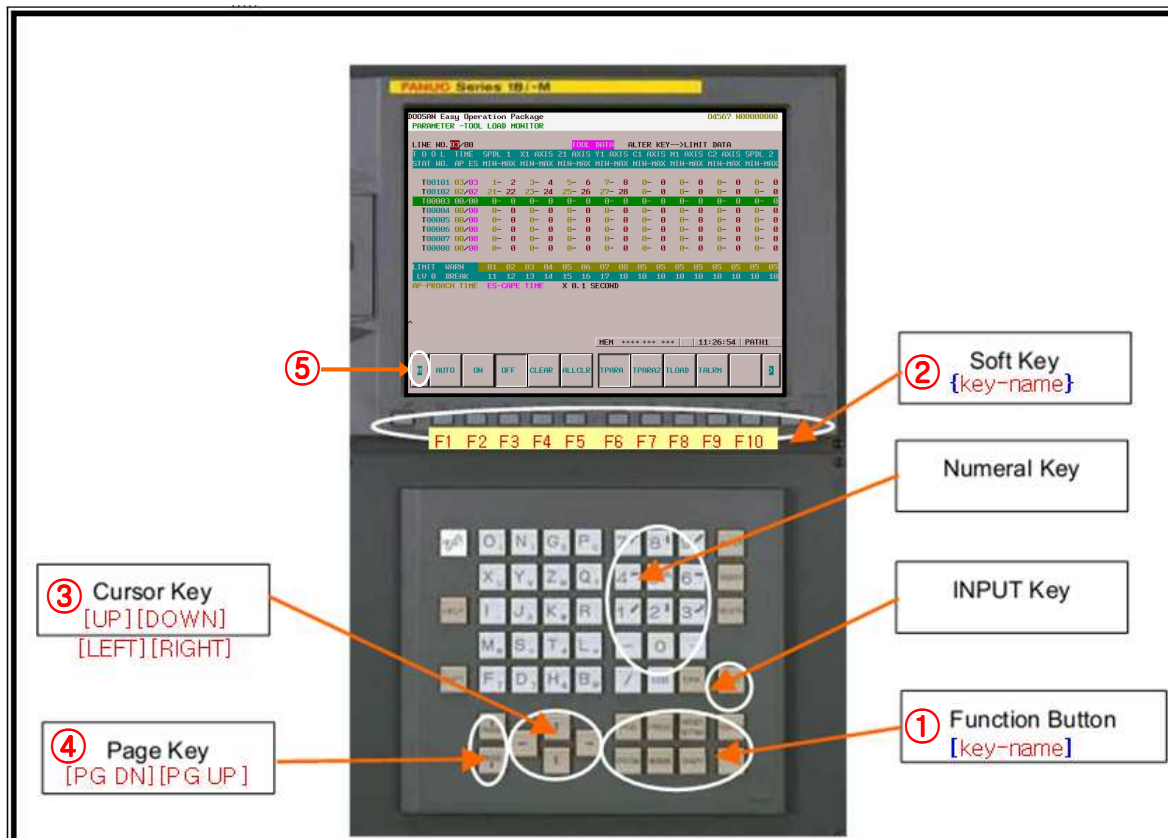② {key-name} ; It stands for F1~F10 menu button located at the below LCD.

③ [UP][DOWN][LEFT][RIGHT] ; Moving Keys among the other FANUC MDI KEYs.

④ [PG UP][PG DN] ; Page down, page up moving keys among the other FANUC MDI KEYs.

⑤ [M] ; Use the {M} Soft Key for returning to main menu

② Soft Key {key-name}

Numeral Key

③ Cursor Key [UP][DOWN] [LEFT][RIGHT]

INPUT Key

④ Page Key [PG DN][PG UP]

① Function Button [key-name]

1.2.1 Cutting operation ready

Divide according to item number in DTMM if program by item (M 700~ M 704) number in load
according to process tool which is same tool post number and detailed and it detects efficiently.

1.2.2 From MAIN Menu to PARAMETER window using {1.T-MONI} key
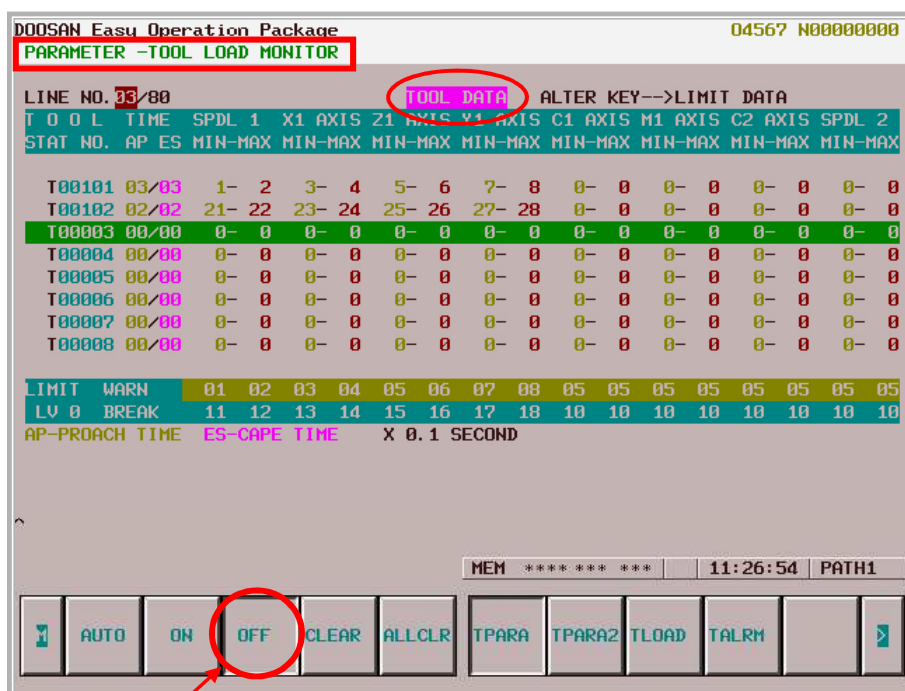
Select the below [OFF] of MENU to operate DTMT and then choice TOOL DATA by pressing
[ALTER].

At this point, select the specific tool by pressing [UP] ↑ [DOWN] ↓ button.

When Initial setup, T00001 ~ T00080 numbers are registered and all of them don't have number.

1.2.3 Register T-CODE in a Manufacturing Program

If T0101,T0202 are used in a manufacturing program, write 0101, 0102 in the TOOL NO black using
[UP][DOWN][LEFT][RIGHT] ← ↑ → ↓ button.

After write each TOOL NO, terminate TOOL DATA EDIT by pressing [UP] ↑ or [DOWN] ↓
MDI BUTTON

When using T0001~T0012 without registering tool and offset number, same tool numbers such
as T0101,T0102 are set T0001 in the TOOL DATA black.

CAUTION

1. After write each TOOL NO, terminate TOOL DATA EDIT by pressing [UP] ↑ or [DOWN] ↓
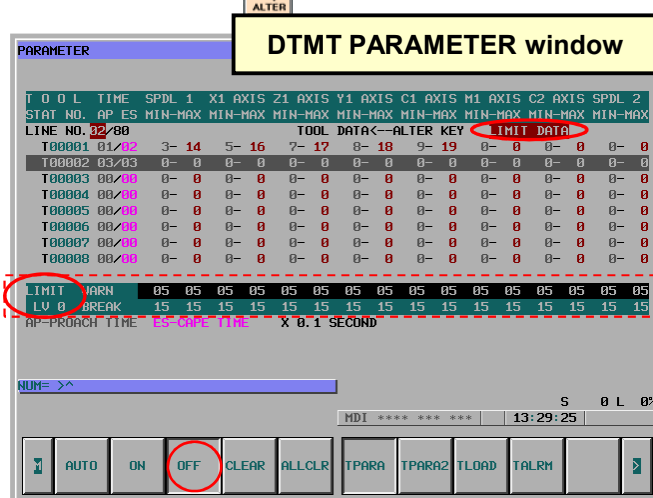
   MDI BUTTON.
2. When use [LEFT] ← or [RIGHT] → in {OFF}, DATA edit mode is activated. So it is

   possible to write a directly specific data. But It is only saved after pressing [UP][DOWN].
   So after manually write data, you must PRESS [UP][DOWN] to save data by exiting DATA
   edit mode.

1.2.4 Set LIMIT LV 0 value.

Select *LIMIT LV 0* *by pressing [ALTER]* ▧ *.*

DTMT PARAMETER window

When selecting LIMIT WARN and BREAK line, Press [DELETE] ▧ and then it is automatically set to default parameter value.

1.2.5 Measure load of normal manufacturing at {AUTO} Mode

DTMT PARAMETER window
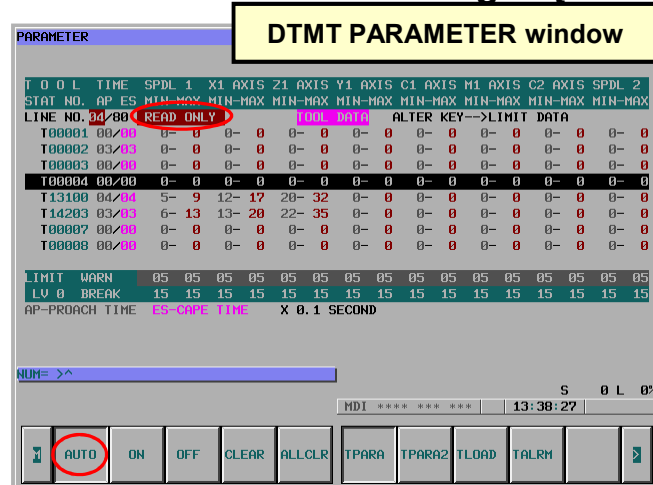
Switch to measurement mode by selecting **{AUTO}.**
At this time, it show **READ ONLY** on the upper side and in this mode you can't modify
PARAMETER.

1.2. 6 Execute automatic measure of cutting load by manufacturing program

Each Override Switch is fixed at 100% and it must not be changed.
(In a detection about load varying, load must be not effected by override in manufacturing)
After execution of the manufacturing program, press [CUSTOM] [CUSTOM1] then change to MAIN

MENU window . Now select [1. T-MONI] button, you can see each measured axis load data in parameter window.

During the process, DTMT will measure the normal load level of the tool of each feed axis, and enter those value into the system so you could see on window.

If MAIN/SUB SPINDLE is using CSSC(Constant Surface Speed Control), MAIN/SUB SPINDLE are exclusive for abnormal load detection/Measurement, because, even in the normal condition cutting, there is possibility to happen sudden turning axis's acceleration and deceleration.

DTMT PARAMETER window

1.2.7 Starting abnormal load detection by {ON} key.

It is now ready to use DTMT to detect abnormal load, you may put next work-piece to perform same program at feedrate override 100%

DTMT PARAMETER window

1.2.8 How to handle releasing abnormal load alarm

When abnormal load occur, PMC ALARM will be generated and messages will appear at DTMT ALARM HISTORY. WARN/BREAK LIMIT OVER SIGN (W or B) and Alarm will appear at DTMT PARAMETER of problem Tool. Select {TALRM} after push [CUSTOM] [CUSTOM1] button, DTMT ALARM HISOTRY window

appear, at this window you can see information of time/tool/axis/the value of abnormal load. Select the tool for exchange, which depends on information from DTMT ALARM HISTORY window.

DTMT ALARM HISTORY window
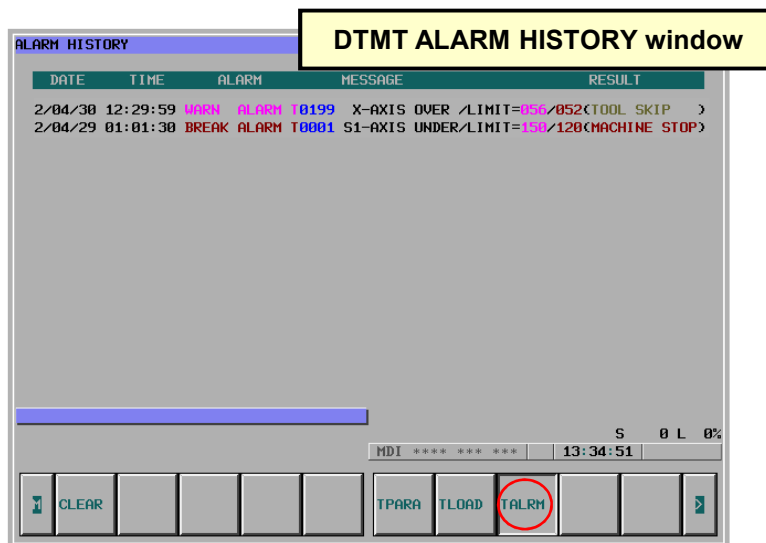
When Alarm occurs, select either [POS] [POS] or [PROG] [PROG] to change this window to the standard NC

window and push [RESET] [RESET] button to release PMC alarm.

Inspect the tool condition and exchange Tool.

Also, select [CUSTOM] [CUSTOM1] button for DTMT PARAMETER window and select either [RESET] [RESET] or

{CLEAR} to release DTMT ALARM.
.

DTMT PARAMETER window

1.3 DTMT detail description for composition of window
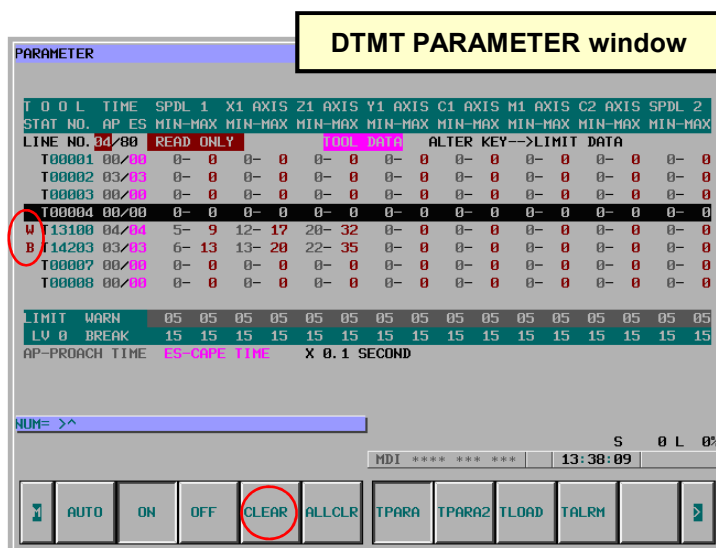
1.3.1 Description for each DTMT PARAMETER
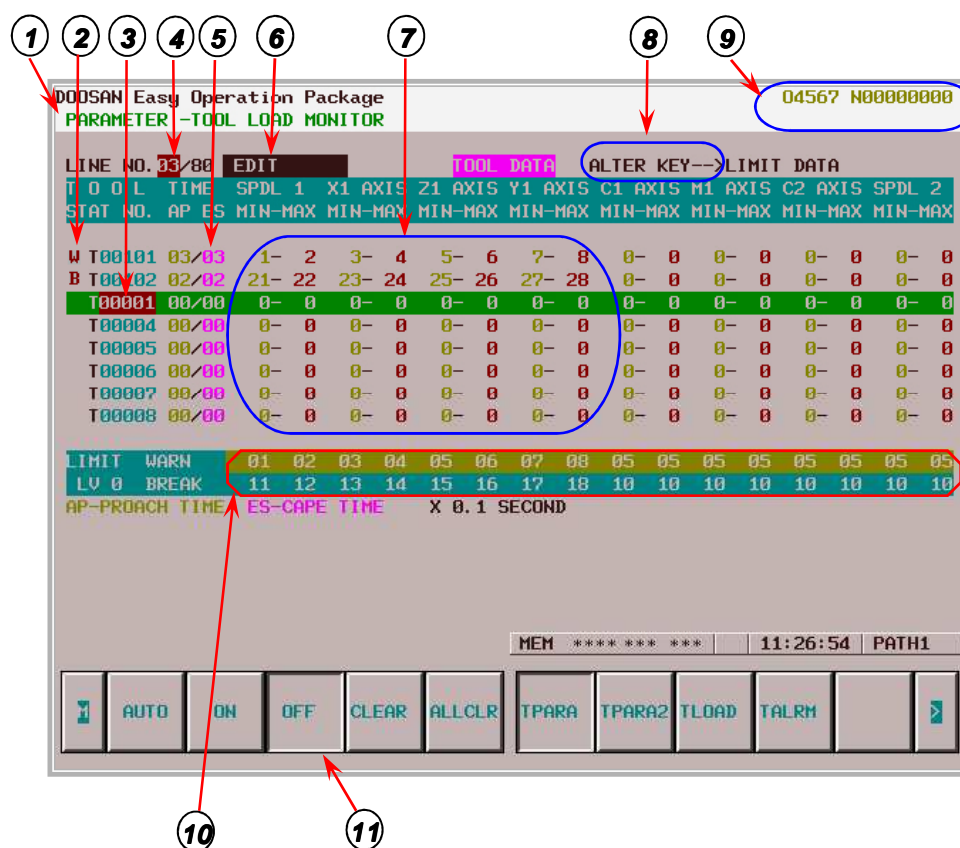
① DTMT window description `DOOSAN Easy Operation Package` / `PARAMETER -TOOL LOAD MONITOR`

Above picture is the program window of **D**oosan **T**ool load **M**onitor for **T**urning centers.
This window is about Parameter of Tool Load Monitor .

② Tool Condition Warn, Break sign (W or B signs appear in front of tool number)

`LINE NO.` `T O O L` `STAT NO.` `W T00101` `B T00102`

When abnormal load occurs, W, B signs appear at the side of each problem tool.
If you choose DTMT Parameter window, when abnormal load detection PMC-ALARM occurs
you will see W or B been marked. You need clear alarm by selecting [RESET] key after
change the problem tool.

③ ***Input space for tool list which will be inspected*** (manually write)

`LINE NO. 03/80 EDIT` `T O O L  TIME  SPDL 1  X1` `STAT NO.  AP ES MIN-MAX MI` `W T00101 03/03  1- 2` `B T00102 02/02  21- 22  2` `T00101 00/00  0- 0`

Initially, total 80 tool number s are set from T0001 to T00080 .
You must register a combination of tool and offset number to measure and
detect load. In the registered tool number , You can manually edit abnormal
load range

④ Currently selected DTMT Parameter Line number `LINE NO. 03/80`
Above picture indicates the line selected to currently edit in the Tool Data List
You can register up to 80 number combined of tool and offset number.

⑤ Input space for Approach Time, Escape Time

`TIME` `AP ES` `03/03` `02/02` `00/00` `00/00` `00/00`

Air Cutting temporarily occurs when before tool contact the material(Approach) and after
cut material(Escape).
At this time, write Escape Time on ES space and Approach Time on AP space with 100[msec]
unit. Air Cutting can not be detected at the tool broken moment, when written value is not
correct.

It is proper 5(500msec) to each item when normal cutting travel. Because it's time is too short.
When abnormal states occur, Alarm regarding ES(Escape Time) value is lately released.
So write small escape value on manufacturing program .
When cutting transfer is on the Pocket region, using Tool Monitor on/off M code at front and back block
corresponding Air Cutting and then it is not detect load measurement and abnormal state.
  M20**0** temporarily abnormal load detection is paused (TOOL MONITOR **OFF**)
  M20**1** pause of abnormal load detection is released (TOOL MONITOR **ON**)
Automatically operation mode is switched to M20**1** state (TOOL MONITOR **ON**), even though program
issues M20**0** to pause on termination of auto operation. When you want operation of DTMT to pause
(unused), select {OFF} of DTMT PARAMETER MENU.

⑥ DTMT Parameter edit mode `EDIT` `READ ONLY`
 It shows the mode that the data is "Read only" can be edited.
When DTMT is operating(because you selected{AUTO},{ON}), you cannot edit Parameter because it is
condition of READ ONLY.
However, When DTMT is not operating(because you selected {OFF}), if you use [LEFT] ← [RIGHT] →

to move to the certain line in the Parameter, automatically condition is change to EDIT, so you can edit DATA.
However, you have to finish EDIT condition by pushing either[UP] ↑ or [DOWN] ↓ one time.

⑦ Output lines of normal load for each Axis during sample cut.

At DTMT [AUTO] mode, real cut normal load value shows for each registered servo (MAIN SPINDLE, X, Z,Y, C, M, C2, and SUB SPINDLE) after auto-mode process finished.
When SPINDLE rotate with CSSC (Constant Surface Speed Control) mode, load value shows for only when X-axis is not moving. Other Servo- Axes (Not-SPINDLE) shows value only when feed-axis is moving. Each axis output shows min. and max. cutting load values.
However, if you want turn-off detecting UNDERLOAD (AIR CUTTING), set MINand if you turn-off detecting OVERLOAD set MAX as 0

⑧ **DTMT Parameter Table select**
It shows the selected Data Table to edit.
There are 2 table in DTMT Parameter window, one is Tool Data Table and Limit Data Table which set the range of permissible Load. To edit DATA, you need to select one of two tables by [ALTER] key.

⑨ Execution program and the sequence number 04567 N00000000
Just like standard Fanuc CNC window, this stands for program number and sequence number.

⑩ Space for permissive overload

You must set permissive overload range for generating WARNNING ALARM and BREAK ALARM. Use [ALTER] key to select LIMIT DATA and use

[LEFT] [RIGHT] [PAGE UP] [PAGE DOWN] to edit.(See ⑧)

After selective line, if you push [Delete] key, all the default parameters will be set automatically.

Followings are sample values

DTML PARAMETER
X AXIS

	MIN	-	MAX
T0001	20	-	30
:	:	:	:
WARN	05	-	08
BREAK	10	-	16

Break Overload Alarm (Load value > MAX(30) + MAXBREAK(16)=46)
Warn Overload Alarm (Load value > MAX(30) + MAXWARN(8)=38)

NORMAL LOAD (MAX(30) < Load value < MAX(30) + MAXWARN(8)=38)
NORMAL LOAD (MIN(20) <= Load value <= MAX(30))
NORMAL LOAD (MIN(20) > Load value > MIN(20) – MINWARN(5)=15)

Warn Underload Alarm (Load value < MIN(20) - MINWARN(5)=15)
Break Underload Alarm (Load value < MIN(20) - MINBREAK(10)=10)
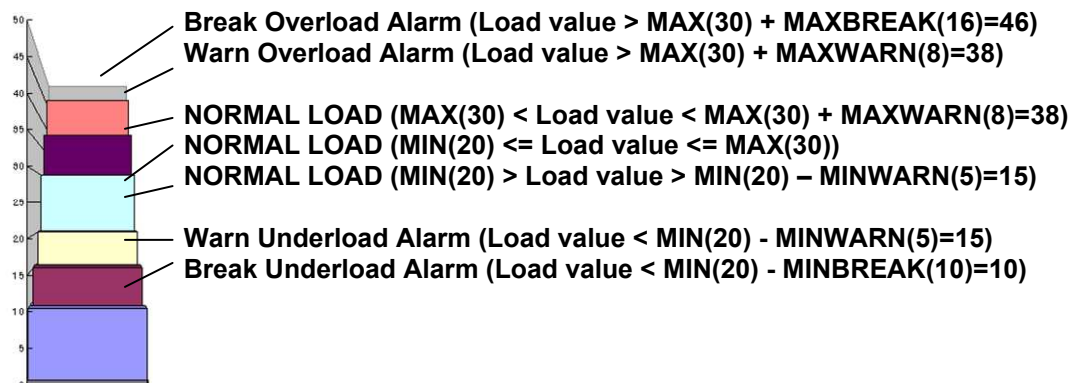
From following example,
Normal loads of X-axis % value is 20 ~ 30% for Real Cut. If you include WARN LIMIT value, 15 ~ 38% is normal. So, if values is under 15% or above 38%, DTMT will send WARN ALRM(Tool Skip).
Further more, values is under 10% or above 46%, DTMT will generate Break Alarm(FeedHold)

<u>If any tool of servo axis is over Warm, Break Limit, Alarm is released.</u>
  When Warm Alarm occur, Alarm message (PMC MESSAGE, DTMT window MESSAGE) appear but machine is normally operated.
  If you Intentionally set WARN or BREAK LIMIT value to 0, there is no more detection about abnormal related tool of axis.

⑪ DTMT Parameter Menu

[DTMM PARAMETER Edit & Operation mode]

DTMM PARAMETER Display

| M | AUTO | ON | OFF | | ALLCLR | PARA | LOAD | ALARM | HELP | | > |

[Windows change mode]

DTMM MAIN Display
DTMM LOAD DISPLAY
DTMM ALARM HISTORY Display
DTMM HELP Display
Other DTMM Display
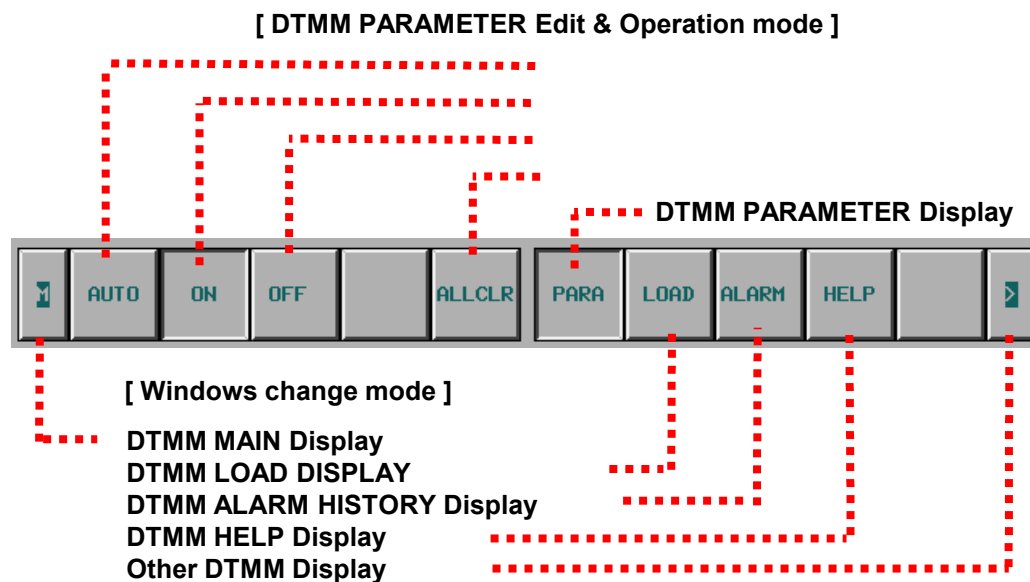
M : If you use DOOSAN Easy GUIDE option, DTMM MAIN window has menu to change from
standard NC PROGAM window to DOOSAN Easy GUIDE.

> :Move to the other DTMM window. From DTMM PARAMETER window, it move to
DTMM LOAD DISPLAY window
.

1.3.2 DTMT LOAD DISPLAY additional edit function

① After select 1 line and push [DELETE] key, TOOL DATA of this tool goes 0(Zero) and LIMIT DATA goes the given value, PMC PARAMETER, automatically..

② At DTMT EDIT Mode, if you select the one certain DATA and push [DELETE] key, only the one certain DATA goes 0(Zero).

③ When you edit DATA, if you input the value and push [INPUT] key, the value will be a new DATA. However, if you push [INSERT] key after input the value, it only add the value to old value.

④ Select certain line of TOOL DATA and write registered tool number (00001, 00101, 02099 etc) and then it is in the TOOL DATA TABLE .

1.3.3 Explanation of DTMT LOAD DISPLAY window

Each servo's real time load display at DTMT LOAD DISPLAY window. Also, it shows current operating DTMT TOOL NO. and PARAMETER.
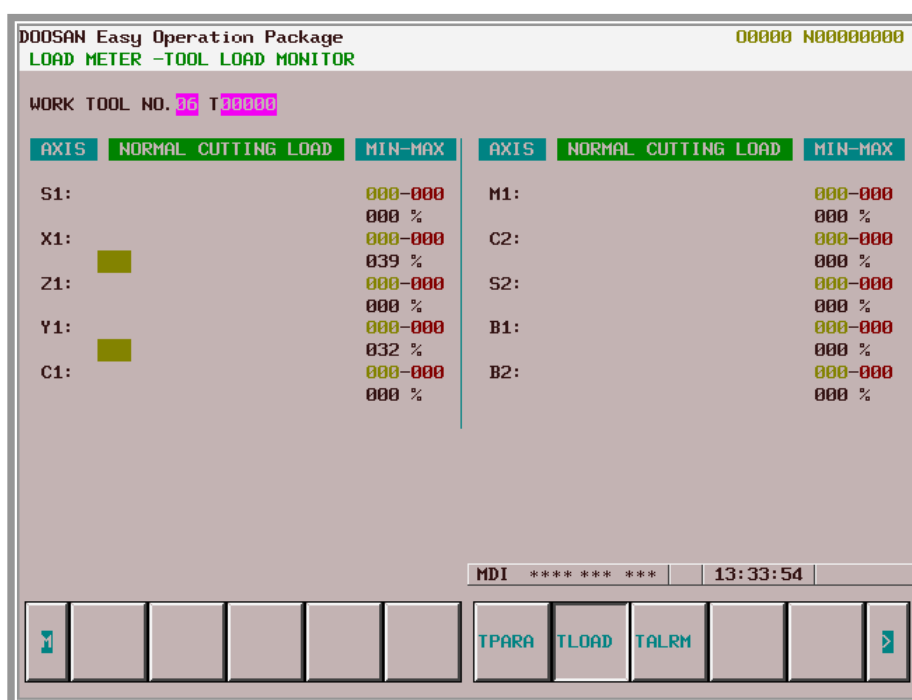
Example from MAIN SPINDLE.

Current using tool line # at DTMT PARAMETER.

Current using tool DTMT PARAMETER registered tool number.

MIN, MAX value for current using Tool

Real value of load and line graph for each axe's

Shown axis for load (S1-MAIN SPINDLE, X, Z, Y, C, M, C2, S-SUB SPINDLE)
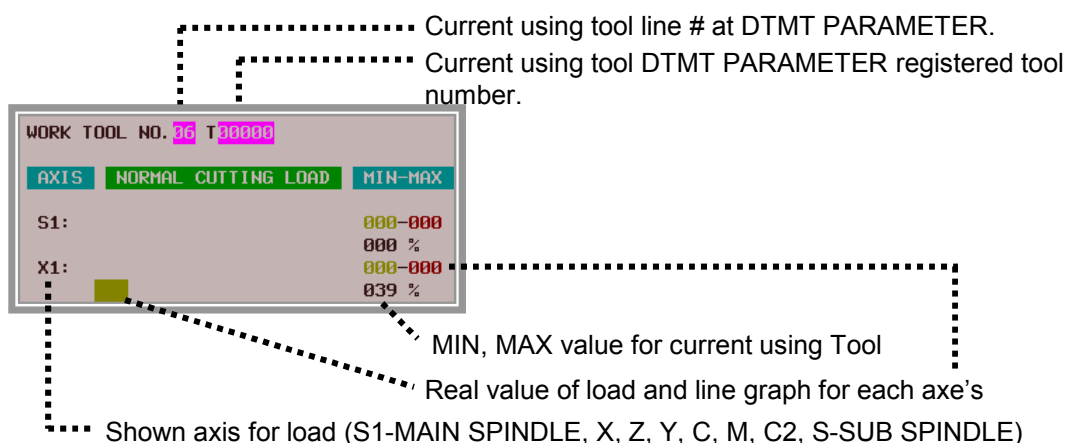
1.3.4 Explanation OF DTMT ALARM HISTORY window

DTMT ALARM HISTORY shows record of abnormal load alarms and it keeps the history of record. It includes Time, Tool, Contents, Servo-axis, and condition of Alarm.

```
DOOSAN Easy Operation Package                              O0010 N00000000
ALARM HISTORY -TOOL LOAD MONITOR

   DATE      TIME      ALARM       MESSAGE                      RESULT

08/11/07 12:29:59 WARN   ALARM T78.9902-AXIS OVER /LIMIT=056/052(TOOL SKIP    )
08/02/20 01:01:30 BREAK ALARM T0205811-AXIS UNDER/LIMIT=150/120(MACHINE STOP)




                                        JOG  **** *** ***  |  15:31:02 | PATH1

  >| CLEAR                            TPARA  TLOAD  TALRM              |>
```

Followings are examples

The Date of Alarm Occur (Year/Mo./Day)

Time of Alarm Occur (Hr./Min./Sec.)

Kind of Alarm (WARN or BREAK)

Tool Number from DTMT PARAMETER

```
   DATE      TIME      ALARM       MESSAGE                      RESULT

08/11/07 12:29:59 WARN   ALARM T78.9902-AXIS OVER /LIMIT=056/052(TOOL SKIP    )
08/02/20 01:01:30 BREAK ALARM T0205811-AXIS UNDER/LIMIT=150/120(MACHINE STOP)
```

Name of Servo-axis

Kind of Alarm (OVERLOAD/UNDERLOAD)

Real value of load and limit value of PARAMETER (Real Value/Limit)

Kind of PMC ALARM

It is possible that load can be smaller for Cutting load than Air Cutting load depends on condition and direction of Tool attachment.
OVERLOAD ALARM may occur during Air Cutting.
Especially, X-axis real cutting load in the Finishing Face Process could be lower than Air-cutting load.
It is good idea that use different offset number to register at DTMT PARAMETER, so, depending on process (Rough, Finishing, Face and ETC).

1.3.5 DTMT PMC PARAMETER, M-CODE 와 ALARM MESSAGE

If you adjust PMC PARAMETER depends on various cutting conditions, you may detect abnormal load better. Also you can use M-CODE when surface of martial is rough so that
There is no detection for abnormal load in related block.
If you change following PMC PARAMETER, you must turn off POWER before you begin processing.

① Default Warn/Break %Overload Value

D-data	Value		Comment
D0850	5	%	Default Warn %Overload Value
D0852	10	%	Default Break %Overload Value

   At DTMT PARAMETER window, if you select LIMIT DATA TABLE and push [DELETE] key, all
   LIMIT DATA TABLE will be set up with value as D0850, and D0852 of PMC data.

② Warnning Alarm Delay Time

D-data	Value	Comment
D0854	1000 m sec	Warn Alarm Delay Time

   It takes about for 300msec to generate Break Alarm after load is over BREAK LIMIT.
   Warn Alarm will be delayed as set by PMC data in D0854.

③ Load Bypass Time

D-data	Value	Comment
D0856	1000 m sec	Load Bypass time for Main/Sub Spindle
D0858	0 m sec	Load Bypass time for X,Z,Y,M
D0860	2500 m sec	Load Bypass time for C,C2

   Spindle could give over load even after SAR is ON during the regular cutting condition or the beginning of cutting that depends on cutting material.
   For every axis, if you may modify values (Bypass time) for D0856~D0860, DTMT does not detect load problem whenever Z-axis change from Rapid-Axis to Feed-Axis before this bypass time as set on [D858], and by pass the load sending the certain time as set D856 and D858 after SAR signal is on.

④ TOOL MONITOR ON/OFF M-CODE
      M200   TOOL MONITOR OFF (Temporary DTMT Stop)
      M201   TOOL MONITOR ON   (Temporary DTMT Stop Release)
   You can stop detecting abnormal load for the certain axis, tool, BLOCK.
   If you want to omit detection for certain axis, you need to set the certain axis LIMIT DATA as 0(Zero).
   If you may ignore overload for the certain tool, don't register the certain tool at DTMT PARAMETER.
   If you want to ignore the overload detection for the certain BLOCK, add M200, M201 before the BLOCK and after the BLOCK.
   M200 M-CODE is for TOOL MONITOR OFF by M-CODE, TOOL MONITOR will ON at the end of the program.
   If you want to stop detection continuously, select {OFF} key which located at bottom of DTMT PARAMETER window.

⑤ PMC ALARM MESSAGE
   PMC Alarm occur as Warn Alarm (Tool Skip Alarm): number 2086, Break Alarm (FeedHold Alarm): number 2087
   2086 TOOL MONITOR ALARM.
         DETECT ABNORMAL LOAD AND TOOL WARN ALARM
   2087 TOOL MONITOR ALARM.
         DETECT ABNORMAL LOAD AND TOOL BREAK ALARM
   When number 2087(break alarm) occur, you must exchange tool and go to DTMT PARAMETER window push either {CLEAR} key or [RESET] key at the bottom menu.

1.4 DTMT Load Measurement &Detection standard

1.4.1 Normal Load Measurement Method

In the actual cutting manufacturing, There are abnormal load of acceleration and deceleration of each servo axis and the spindle. In this region, you avoid detecting normal or abnormal load. For detecting Under load, you except approach and escape value in measurement range.

DTMT measure normal load and detect abnormal load with following standards.

① Only measure normal load and detect abnormal load for servo-axes which are factory pre-set from MTB such as MAIN SPINDLE, X, Z, Y, C, M, C2, and SUB SPINDLE.

② Only measure normal load and detect abnormal load for Tool number registered at DTMT PARAMETER.

③ Only measure normal load and detect abnormal load for LIMIT DATA is not 0(Zero) at DTMT PARAMETER.

④ It does not measure normal load and detect abnormal load after M200 (TOOL MONITOR OFF) command and before M201 (TOOL MONITOR ON) command.
It goes M201 automatically at the end of the program.

⑤ Only measure normal load and detect abnormal load for axis, which is rotating or moving feed-axis at feed-axis mode (G01/02/03). Further more, if the operation is not Auto-Mode or is not in feed, DTMT does not measure normal load and detect abnormal load.

⑥ It does not measure normal load and detect abnormal during change from rapid-axis move to feed-axis move during PMC PARAMETER Load Bypass Time. (See 1.3.5-③)

⑦ It does not measure normal load and detect abnormal during between servo-axis move to stop or stop to move for 1 scan time (=250msec), because DTMT consider this time as range of acceleration/ deceleration.

⑧ It does not measure normal load and detect abnormal during changing to feed-axis mode (G01/02/03) for the amount of DTMT PARAMETER AP (approach time).
Because this time is Approach Time, to detect under-load, DTMT does not measure normal load and detect abnormal during change.

⑨ It does not measure normal load and detect abnormal during changing to feed-axis mode (G01/02/03) for the amount of DTMT PARAMETER ES (Escape time).
Because this time is Escape time, to detect under-load, DTMT does not measure normal load and detect abnormal during change.

⑩ DTMT measure normal load and detect abnormal for every 1 scan-time (=250msec).
So, if abnormal load is less than 1 scan-time (=250msec), it is possible that DTMT cannot measure normal load and detect abnormal.
Further more, if there is rapid-axis block which shorter than 1 scan time between feed-axis blocks, explanation at 1.4.1 ⑨ can not be operated.

1.4.2 Example of normal Load Measurement

Following is example of DTMT Z-axis load measurement .

FEED axis move signal
Z-axis move signal

Z AXIS LOAD WITH APPROACH TIME

Real Time Z-axis servo %load   Z-axis servo %load after filtering(2nd) of AP

No measuring block for AP period.
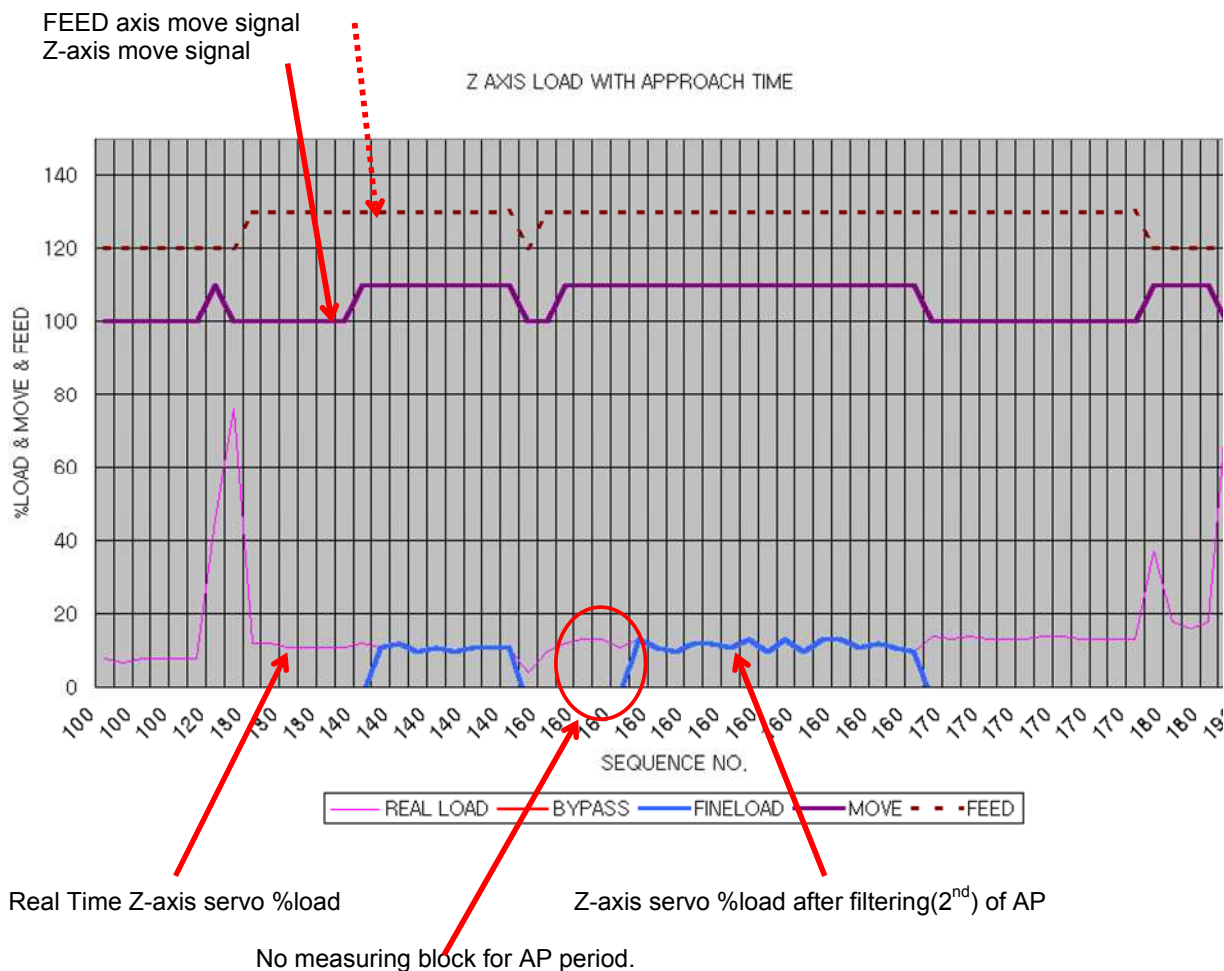
DTMT use 3 filters by software to measure and detect load for servo-axes.
Percent (%) load from every servo amplifier go through 1st filter which removes measuring of acceleration/deceleration block and by-pass block. AP block load will be remove by 2nd filter, ES block load will be removed by 3rd filter

You can see "No measuring block for AP period" has 0(Zero) load.
Following graph shows %load by the 2nd and the 3rd filter.
Because AP was set as 0(Zero) for this graph, the load after the 2nd filtering is same as after the 1st filtering

FEED axis move signal
Z-axis move signal

Z-AXIS LOAD WITH ESCAPE TIME

Real Time Z-axis servo %load

Z-axis servo %load after filtering(3rd) of ES

No measuring block for ES period.

Load value after filtering acceleration/ deceleration block, by-pass block and ES
(2nd filter, AP=0)
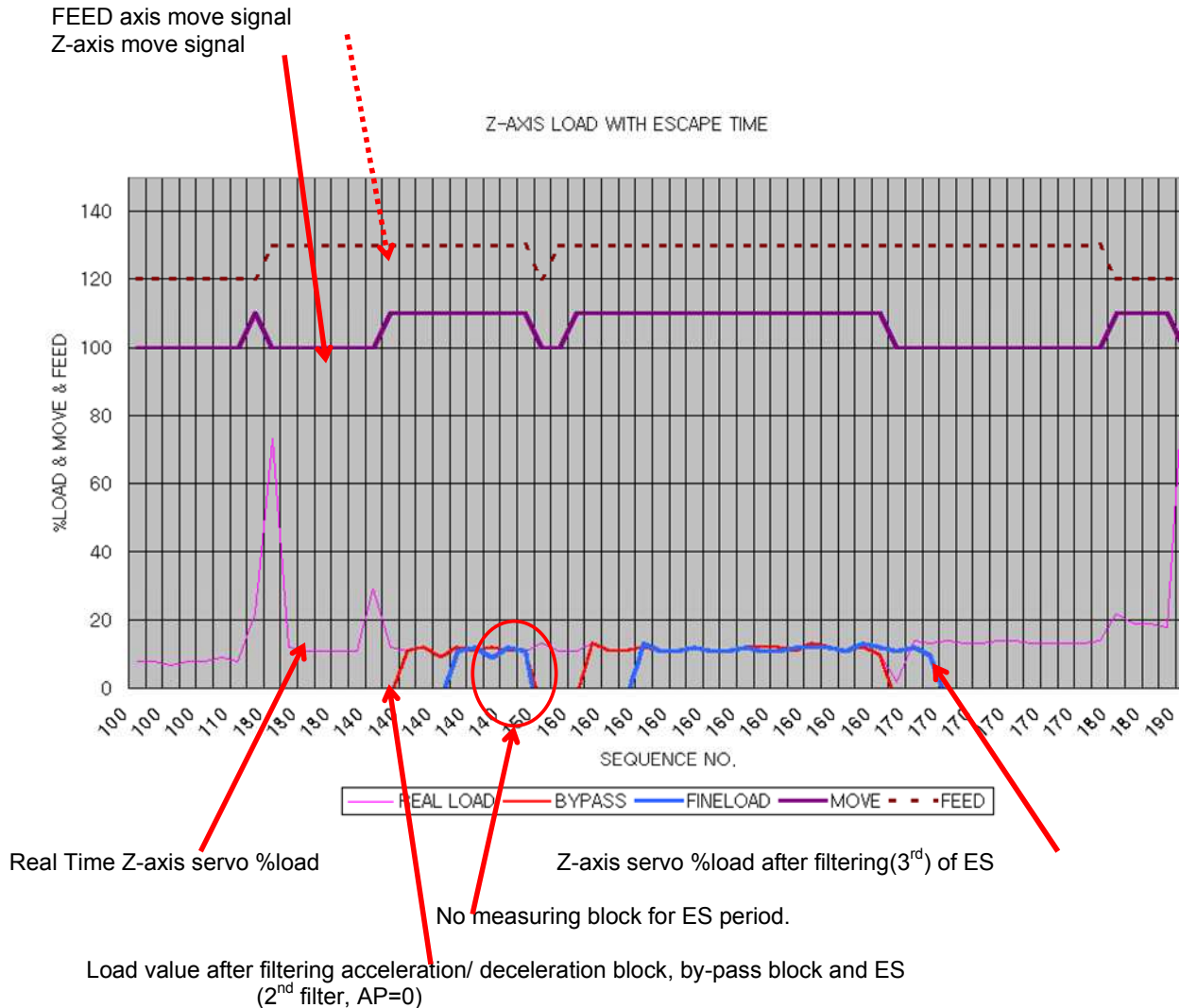
Even though normal cutting condition, no-load can occur during ES block, so don't measure and detect load for that period, but we cannot find block of changing feed-axis move to rapid axis move, so we delay real-time %load after 2nd filter as much as Escape time.

According to graph, we can find ES delaying after filtering acceleration/ deceleration block, and by-pass block. Also, from "No measuring block for ES period" we can find the value after 2nd filtering and 3rd filtering are different and it has been removed as much as the delayed time.

DTML use delay filter to measure and detect under-load during ES block, real alarm occurs after abnormal load detected and Escape Time passed.

So, it is a good idea that you program work process with the smallest Escape Time possible, which makes alarm fires quickly.

1.5 Additional Part

1.5-1. WARN / BREAK LIMIT *LEVEL* to Append

WARN / BREAK LIMIT   table one more add (LV 0 / LV 1)

{TPARA2}select => LIMIT LEVEL 0 ☞ 1   input => LV 0 ▸ LV 1 .

T00003   WARN / BREAK LIMIT table (LV 0 , LV 1).

5-2. B1,B2 AXIS to Append ({TPARA2} , {TLOAD})

5-3. To change   TOOL   a number of five ciphers   (4 cipher->5 cipher)_ Only MX -Series

EX) T13100 ; **TOOL number 13**   / **OFFSET number 100**

2. BACKUP

2.1 BACKUP - TOOL LOAD MONITOR
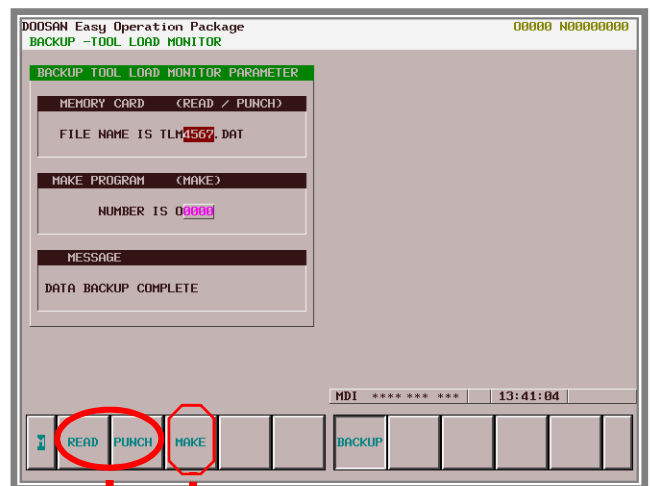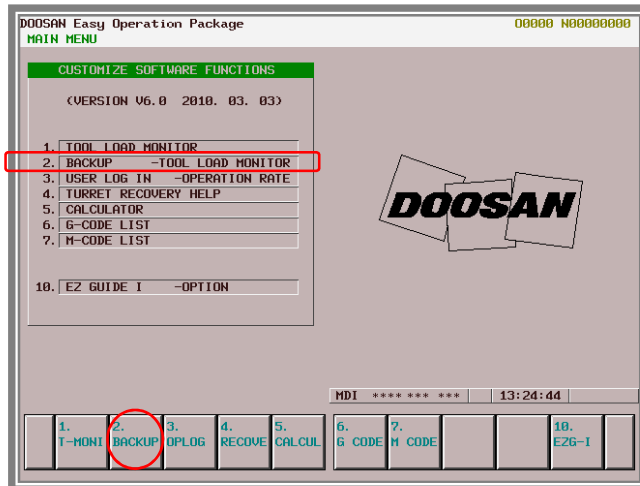
PCMCIA Memory Card
Tape Memory
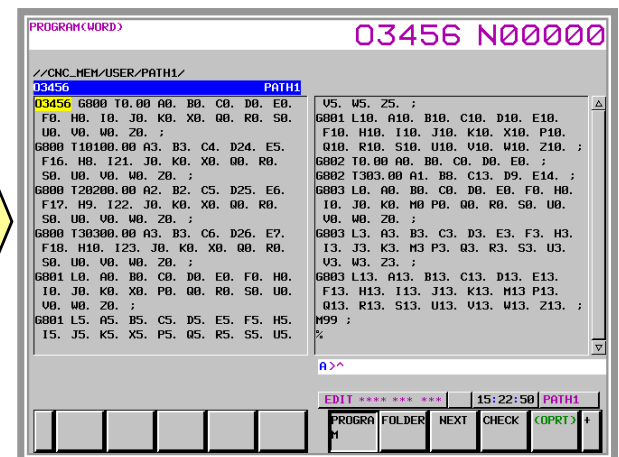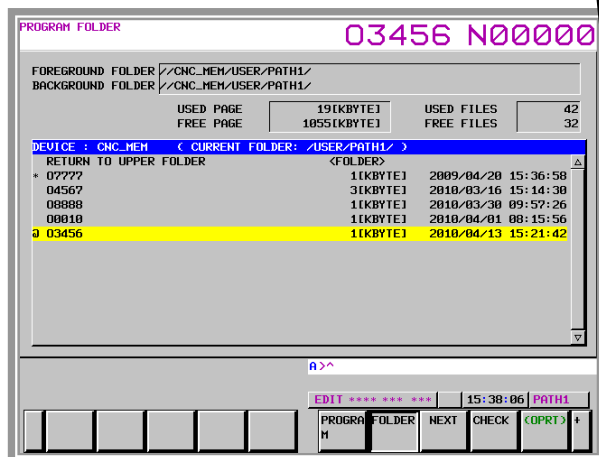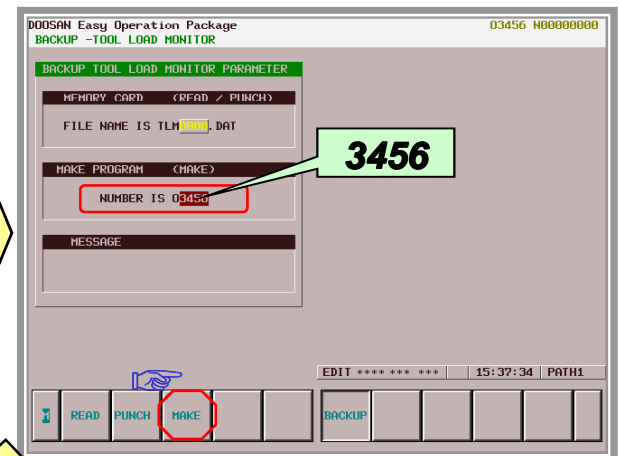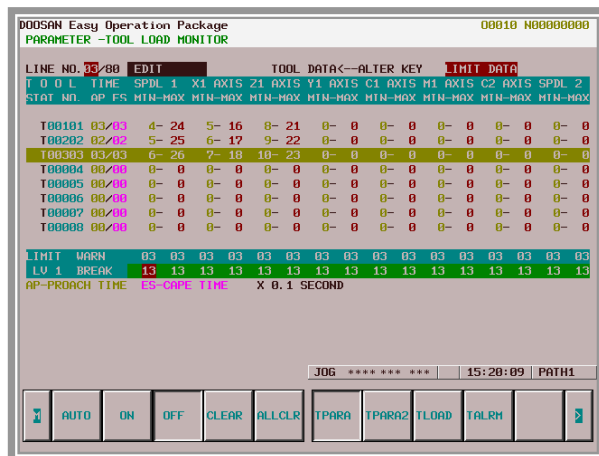
3. User Log In – Operation Rate

3.1 *INTRODUCTION*

OPER (Operation Rate Function) shows the operate and work time for 3 workers. The operation time are Spindle Load Time, Cutting Feed Move Time, and Operating Time on auto or jog mode.
Only a master can see the result of operation by logging passwords.
OPER has 3 windows, there are LOG, LIST, RANGE.
On LOG window, 3 workers and a master must input the log-in password before he operate the machine to count the work time.
On LIST window, a master can see the Operation Rate Data during 35 days.
On RANGE window, a master can see Operation Rate Data for 1 day or 35 days in detail.

3.2 *BASIC OPERATION*

Useful Definition which you need to know
[key-name] ; It stands for FANUC MDI key (POS, PROG, RESET, DELETE and etc).
{key-name} ; It stands for F1~F10 menu button located at the below LCD.
[UP][DOWN][LEFT][RIGHT] ; Moving keys among the other FANUC MDI keys.
[PG DN][PG UP] ; Page down, page up moving keys among the other FANUC MDI keys.
Use the [M] Soft Key for returning to main menu.
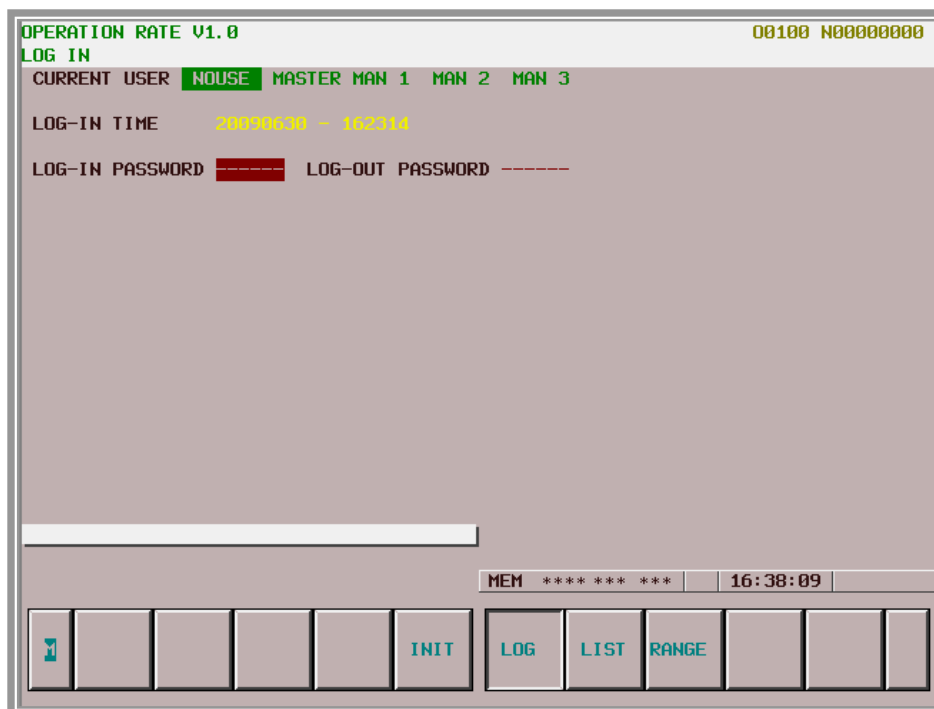
3.2.1 Log in/out Flow.

Before customer use this function, change the password by log-in password '30'.
(1) select {OPLOG} button of the main menu to view the Operation Rate Logging window.

```
OPERATION RATE V1.0                              O0100 N00000000
LOG IN
 CURRENT USER  NOUSE  MASTER MAN 1  MAN 2  MAN 3

 LOG-IN TIME     20090630 - 162314

 LOG-IN PASSWORD ------   LOG-OUT PASSWORD ------




                                      MEM  **** *** ***    16:38:09

        █                        INIT   LOG   LIST  RANGE
```

(2) For using first, type '30' to log-in with the master mode.
   If do not log in, type '42080857' and then push [INIT] Soft Key to initialization and be off the power and then be on and then retry type '30'.
   Do change other passwords for workers and master using [LEFT][RIGHT] key.
   For 3 workers, they have log-out passwords, but a master do not has log-out password.
   If a master change to other window and return to this logging window, it is log-out automatically.
   A master has two passwords ; EDIT and VIEW, one to edit passwords and operation count rule, other to view LIST, RANGE data.
   When a master log by EDIT password, he can edit passwords and count rules.

```
OPERATION RATE V1.0                              O0100 N00000000
LOG IN
 CURRENT USER   NOUSE  MASTER MAN 1  MAN 2  MAN 3

  LOG-IN TIME     20090630 - 162314

  LOG-IN PASSWORD ------   LOG-OUT PASSWORD ------
                                           RULE COUNT OPERATION TIME
   MASTER                                 UNDER AUTO MODE
  CHANGE PASSWORD  LOG-IN LOG-OUT          EXECUTING          YES
                                           OVERRIDE X 100     NO
  WORKER MAN 1      000001 000010          NO MACHINE LOCK    NO
         MAN 2      000002 000010
         MAN 3      000003 000010          MAIN SPDL LOAD   >=008%
  MASTER VIEW       000020  AUTO          UNDER JOG MODE
         EDIT       000030  AUTO           MOVE AXIS          NO
                                           SPINDLE ROTATE     NO




                                       MEM  **** *** ***    17:13:51

    ▓              LOG  LIST RANGE
```

3.2.2 Edit the rules of counting operation time.

To select other value using [LEFT][RIGHT] key. And input '0' or '1' to change 'NO' or 'YES' on the rule parameter.

```
 RULE COUNT OPERATION TIME

  UNDER AUTO MODE
   EXECUTING          YES
   OVERRIDE X 100     NO
   NO MACHINE LOCK    NO

   MAIN SPDL LOAD   >=008%
  UNDER JOG MODE
   MOVE AXIS          NO
   SPINDLE ROTATE     NO
```

The Operating/Working Time is Counted by 3 ways.
1 : Operating Time.
2 : Cutting Feed Move Time under Operating Time.
3 : Detect Spindle Load Time under Cutting Feed Move Time.

Operating time is counted by 'Rule Count Operation Time' parameters.

Operating time is counted when
- Program is executing and not under feed hold, single block if 'EXECUTING' is set.
  If 'EXECUTING' is not set, Operation time is up on Auto Mode under feed hold or single block condition.
- And Feed Rate/Spindle Override are over 100% if 'OVERRIDE X 100' is set.
  If 'OVERRIDE X 100' is not set, Operation time is up under feed rate 0%,10%...
- And Not under Machine Lock status if 'NO MACHINE LOCK' is set.
- And Axis move under JOG mode if 'MOVE AXIS' is set.
- And Spindle rotate under JOG mode if 'SPINDLE ROTATE' is set.

Cutting Feed Move time is counted on G01/G02/G03 when operating time is counted.
Spindle Load time is counted when spindle load is over 'MAIN SPDL LOAD' value.
When cutting feed move and Operation time is counted.

3.2.3 View the total times for days by LIST window.

Select {LIST} button to view the Operation Rate LIST window.
A master can see the counted operation rate data during 35 days.
Push {DELETE} to remove the selected data.
Push {ALLCLR} to remove all the data for new start.

```
OPERATION RATE V1.0                        O0110  N00000
LOG IN

              OPERATION TIME - DAY      OPERATION TIME - POWER ON
 NO.  DATE    ALL  MAN1 MAN2 MAN3       ALL  MAN1 MAN2 MAN3

 001  20040504  030% 030% 000% 000%     090% 090% 000% 000%
 002  20040505  099% 099% 000% 000%     100% 100% 000% 000%
 003  20040506  045% 032% 000% 013%     045% 100% 000% 035%
 004  20040507  000% 000% 000% 000%     000% 000% 000% 000%
 005  20040510  033% 033% 000% 000%     099% 100% 000% 000%
 006  20040511  007% 007% 000% 000%     100% 100% 000% 000%
 007  20040512  000% 000% 000% 000%     100% 100% 000% 000%
 008  20040513  000% 000% 000% 000%     000% 004% 000% 000%
 009  20040514  033% 000% 000% 000%     099% 000% 000% 000%
 010  20040517  030% 000% 000% 000%     100% 000% 000% 000%
 011  20040518  021% 000% 000% 000%     100% 000% 000% 000%
 012  20040519  012% 000% 000% 000%     100% 000% 000% 000%


NUM=
                                                 S   0 L  0%
                                EDIT **** *** ***  |  11:16:18

  M  DELETE           ALLCLR    LOG  LIST RANGE
```

The input data's is searched when a master type a date number '20040501' for 2004.05.01 and push [INPUT].

This window is displayed only under a master log-in mode.

'OPERATION TIME-DAY' means how long times does a worker or machine work.
'OPERATION TIME-POWER ON' means how hard does a worker or a machine work under his work times.

- Operation time is defined by the operation rate parameter.
- See the Operation Rate Logging window.

① ②   ③ How long   ④ How hard

```
              OPERATION TIME - DAY      OPERATION TIME - POWER ON
 NO.  DATE    ALL  MAN1 MAN2 MAN3       ALL  MAN1 MAN2 MAN3

 001  20040504  030% 030% 000% 000%     090% 090% 000% 000%
 002  20040505  099% 099% 000% 000%     100% 100% 000% 000%
 003  20040506  045% 032% 000% 013%     045% 100% 000% 035%
```

① The recorded day count number : 1 ~ 35days
  003 : the third day's operation data.
② The Power-on date
  20040506 : 2004 year 5 month sixth.
③ The operation rate as per 1 day ; 24 x 60 minutes.
  MAN1 operation rate = MAN1 operation time [minutes] / 1440 [minutes] X 100 [%]
    13% = he operated during the 13% of a day.
  MAN2 operation rate = MAN2 operation time [minutes] / 1440 [minutes] X 100 [%]
    0% = he did not work.
  MAN3 operation rate = MAN3 operation time [minutes] / 1440 [minutes] X 100 [%]
    32% = he operated during the 32% of a day.
  ALL operation rate = (MAN1+MAN2+MAN3's + no-log or a master's operation times) / 1440 [minutes]
               X 100 [%]
    45% = workers or a master operated the machine during the 45% of a day.
④ The operation rate as per the power-on times.
  MAN1 operation rate = MAN1 operation time / MAN1's power-on time X 100 [%]
    35% = he operated the machine during the 35% of his work times.
  MAN2 operation rate = MAN2 operation time / MAN2's power-on time X 100 [%]
    0% = he did not work.
  MAN3 operation rate = MAN3 operation time / MAN3's power-on time X 100 [%]
    100% = he operated the machine during the full times of his work times.
  ALL operation rate = (MAN1+MAN2+MAN3's + no-log or a master's operation times) / power-on time
               X 100 [%]
    45% = workers or a master operated the machine during the 45% under Power-ON.

3.2.4 View the detail times for days by RANGE window

To see a detail operation time of a selected day. Push {RANGE} button.
On RANGE window, a master can see the detail work times for 3 workers during a selected day or selected days.

① **The Date of selected day or days**

② **The times of selected day or days**

③ **The detail operation times**
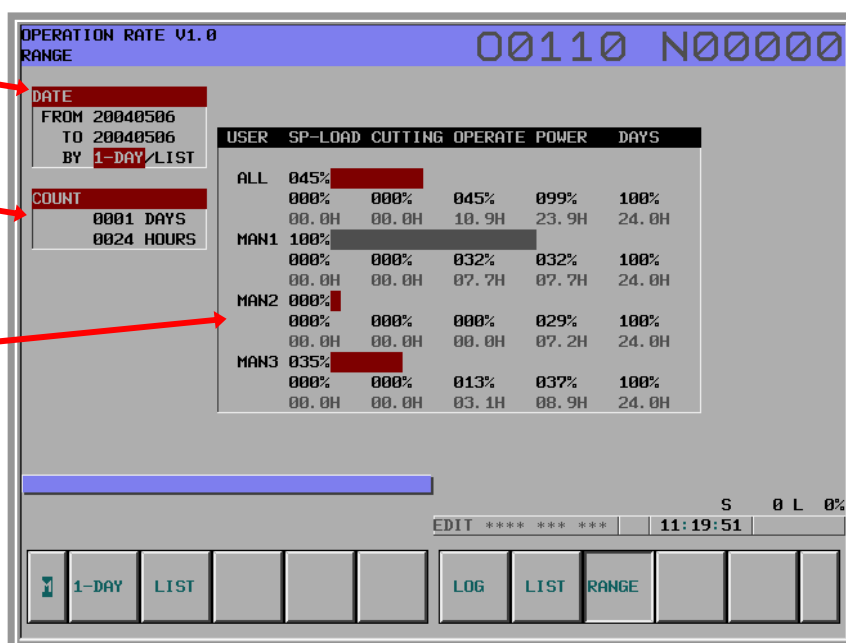
(4) **Operation Rate Bar =**
Operation time/Power on

(5) **SP-load, cutting, operation, and**
Power on times per days

(6) **The detail times [Hours]**

USER	SP-LOAD	CUTTING	OPERATE	POWER	DAYS
ALL	045%				
	000%	000%	045%	099%	100%
	00.0H	00.0H	10.9H	23.9H	24.0H
MAN1	100%				
	000%	000%	032%	032%	100%
	00.0H	00.0H	07.7H	07.7H	24.0H
MAN2	000%				
	000%	000%	000%	029%	100%
	00.0H	00.0H	00.0H	07.2H	24.0H
MAN3	035%				
	000%	000%	013%	037%	100%
	00.0H	00.0H	03.1H	08.9H	24.0H

By this detail information, a customer (master) can see a worker's work times (Power on) and how harder did a worker work (Operation Rate Bar).
And a customer can check his machine's operation time.

4. TURRET RECOVERY HELP

```
DOOSAN Easy Operation Package                    00001 N00000000
 TURRET RECOVERY HELP

 RECOVERY STEP                      TURRET RELEVANT SIGNAL   STATUS
                                    MACHINE READY        : ON
  1.THERE IS EMERGENCY CONDITION    CLAMP CHECK   (X4.6) : ON
  TURN ON THE EMERGENCY SWITCH AND  UNCLAMP CHECK (Y4.6) : OFF
  PRESS THE MACHINE READY BUTTON    UNCLAMP KEEP  (K5.4) : OFF
  ON THE OPERATION PANEL.
                                    GUIDE
  2.SET KEEP RELAY K5.4 TO 1 OF     1.TURRET RECOVERY HELP SCREEN
  MACHINE OPERATION PANEL SCREEN      SPECIFIES THE RESTORATION
                                      METHODS WHEN TURRET IS AT AN
  3.ALIGN TOGETHER THE TURRET         EMERGENCY STOP OR ELECTRIC
  STATION SIDES AS TOOL NUMBER        POWER IS SHUT DOWN. IN ADDITION
  INSTRUCTED BY HAND.                 IT SHOWS ALSO HOW TO RESTORE
  PRESS THE OK SOFT KEY IF WAITING    WHEN TURRET IS CLAMPED IN THE
                                      CONDITION WHERE THE NUMBER OF
                                      CURRET TOOL IS NOT THE SAME
                                      WITH THE NUMBER OF INSTRUCTED
                                      TOOL.
                                    2.FOLLOW THIS PROCEDURE AND
                                      CHECK SIGNAL STATUS.

                           EDIT **** *** ***    13:47:25

   [M]   OK   PREV
```

```
DOOSAN Easy Operation Package                    00001 N00000000
 TURRET RECOVERY HELP

 RECOVERY STEP                      TURRET RELEVANT SIGNAL   STATUS
                                    MACHINE READY        : ON
  4.SET KEEP REALY K5.4 TO 0 OF     CLAMP CHECK   (X4.6) : ON
  MACHINE OPERATION PANEL SCREEN.   UNCLAMP CHECK (Y4.6) : OFF
                                    UNCLAMP KEEP  (K5.4) : OFF
  5.PRESS THE MODE KEY AND CHANGE
  OPERATING DISPLAY TO PARAMETER    GUIDE
  FIXING MODE.                      1.TURRET RECOVERY HELP SCREEN
  (SERVO DRIVE in CONTROL PANEL)      SPECIFIES THE RESTORATION
                                      METHODS WHEN TURRET IS AT AN
  6.PRESS UP KEY AND CHANGE           EMERGENCY STOP OR ELECTRIC
  DISPLAY OF THE FIRST TWO            POWER IS SHUT DOWN. IN ADDITION
  SEGMENTS TO 08.                     IT SHOWS ALSO HOW TO RESTORE
                                      WHEN TURRET IS CLAMPED IN THE
                                      CONDITION WHERE THE NUMBER OF
                                      CURRET TOOL IS NOT THE SAME
                                      WITH THE NUMBER OF INSTRUCTED
                                      TOOL.
                                    2.FOLLOW THIS PROCEDURE AND
                                      CHECK SIGNAL STATUS.

                           EDIT **** *** ***    13:47:48

   [M]   OK   PREV
```

4.1 *OPERATION*

1. When pushing {4.RECOVE} Soft Key of main menu, the above window is opened.
2. Use it when TURRET suspended during a revolution by an emergency stop or the wrong operation.
3. Please proceed with operation by RECOVERY STEP on the window left side.
4. When completing relevant STEP operation, [OK] Soft Key is pushed.
5. If I try to read STEP before, [PREV] Soft Key is pushed.
6. If it's Machine Ready In emergency state, converted to next step automatically.
7. The TURRET related signal on the window right side can be confirmed.
8. Use the {M} Soft Key for returning to main menu.

5. CALCULATOR

5.1 CALCULATOR

```
CALCULATOR V1.00                                  O0100 N00000000
COMMON CALCULATION

     RESULT            INPUT 1      INPUT 2
       2.2508            7.0711       3.1416

  RESULT LIST
 01      2.0000 =         1.0000 *      2.0000
 02      0.5000 = SIN    30.0000        0.0000
 03    900.0000 =        30.0000 ^      2.0000
 04      7.0711 = ROOT   50.0000        0.0000
 05      2.2508 =         7.0711 /      3.1416
  GUIDE
 1.INPUT A INPUT1 OR INPUT2 DATA AND PUSH A RELEVANT SOFTKEY
 2.YOU CAN USE OTHER OPERATOR PUSHING > SOFTKEY
 3.YOU CAN REFER TO OPERATION RESULT AT RESULT LIST
 4.WHEN THE NAT BIT -BIT 0 OF PARAMETER 6004- IS SET TO 0
   SOLUTION RANGES: ASIN = 270 TO 90, ATAN = 0 TO 360
 5.WHEN THE NAT BIT -BIT 0 OF PARAMETER 6004- IS SET TO 1
   SOLUTION RANGES: ASIN = -90 TO 90, ATAN = -180 TO 180
 6.SOLUTION RANGES OF ACOS : 180 TO 0


                           EDIT **** *** ***  |  19:48:43

 ][  COMMON  HOLE  ARC  FACTOR        +    -    *    /    ANS  ]>
```

Cursor

Second Soft Key

```
 ][  SIN  COS  TAN  ASIN  ACOS    ATAN  ^  ROOT  PI  ANS  ]>
```

5.2 OPERATION

1. When pushing {CALCUL} Soft Key of main menu, the above window is opened.
2. Use cursor key for selecting INPUT1 or INPUT2.
3. Input a value at INPUT1 and INPUT2.
   (If operation need a first value, you need not input at INPUT2.)
4. Use {+},{-},{*},{/},{SIN},{COS},{TAN},{ASIN},{ACOS},{ATAN},{^},{ROOT} Soft Key for
   operation and then the result is displayed at the RESULT LIST.
5. Use {>} Soft Key for converting first Soft Key to second Soft Key or second Soft Key
   to first Soft Key.
6. Use {ANS} Soft Key for inputting before result value directly at selected INPUT1 or INPUT2.
7. Use {PI} Soft Key for inputting 3.1416 value directly at selected INPUT1 or INPUT2.
8. At No. 05 of RESULT LIST, recent result value is displayed and you can see the before result by 5.
9. Use the {M} Soft Key for returning to main menu.

NOTICE

1. When the NAT bit (bit 0 of parameter 6004) is set to 0 :
   Solution ranges : ASIN = 270 degree to 90 degree , ATAN = 0 degree to 360 degree
2. When the NAT bit (bit 0 of parameter 6004) is set to 1 :
   Solution ranges : ASIN = - 90 degree to 90 degree , ATAN = - 180 degree to 180 degree
3. Solution ranges of ACOS : 180 degree to 0 degree.

[Hole Position Calculation]

```
CALCULATOR V1.00                              O0100 N00000000
HOLE CALCULATION

INPUT DATA                                          A :  ○
C POSITION X          100.0000                      B :  ●
C POSITION Y          100.0000
A POSITION ANGLE       25.0000
B ANGLE FROM A         70.0000
CA LENGTH  L           50.0000

RESULT DATA
A POSITION X          145.3154
A POSITION Y          121.1309                           0°
B POSITION X           95.6422
B POSITION Y          149.8097                    C



                                        EDIT **** *** ***    20:22:44

   M  COMMON  HOLE   ARC   FACTOR        CALCUL        CLEAR
```

Cursor

5.3 OPERATION

1. When pushing [HOLE] Soft Key of calculation menu, the above window is opened.
2. Use cursor key for selecting item of INPUT DATA and then input a value.
3. Refer to the right graphic.
4. Use [CALCUL] Soft Key for displaying calculated result datum.
5. Use [CLEAR] Soft Key for clearing all datum.
6. Use the [M] Soft Key for returning to main menu.

[Arc Position Calculation]

```
CALCULATOR V1.00                                   00100 N00000000
ARC CALCULATION

INPUT DATA
C POSITION X          100.0000                    A :  ○
C POSITION Y          100.0000                    B :  ●
A POSITION ANGLE       25.0000                    I :  —
B ANGLE FROM A         70.0000                    J :  —
RADIUS                 50.0000

RESULT DATA
A POSITION X          145.3154
A POSITION Y          121.1309
B POSITION X           95.6422                           0°
B POSITION Y          149.8097                    C
I                     -45.3154
J                     -21.1309


                                    EDIT **** *** ***    20:32:23


   M  COMMON  HOLE  ARC  FACTOR        CALCUL      CLEAR
```
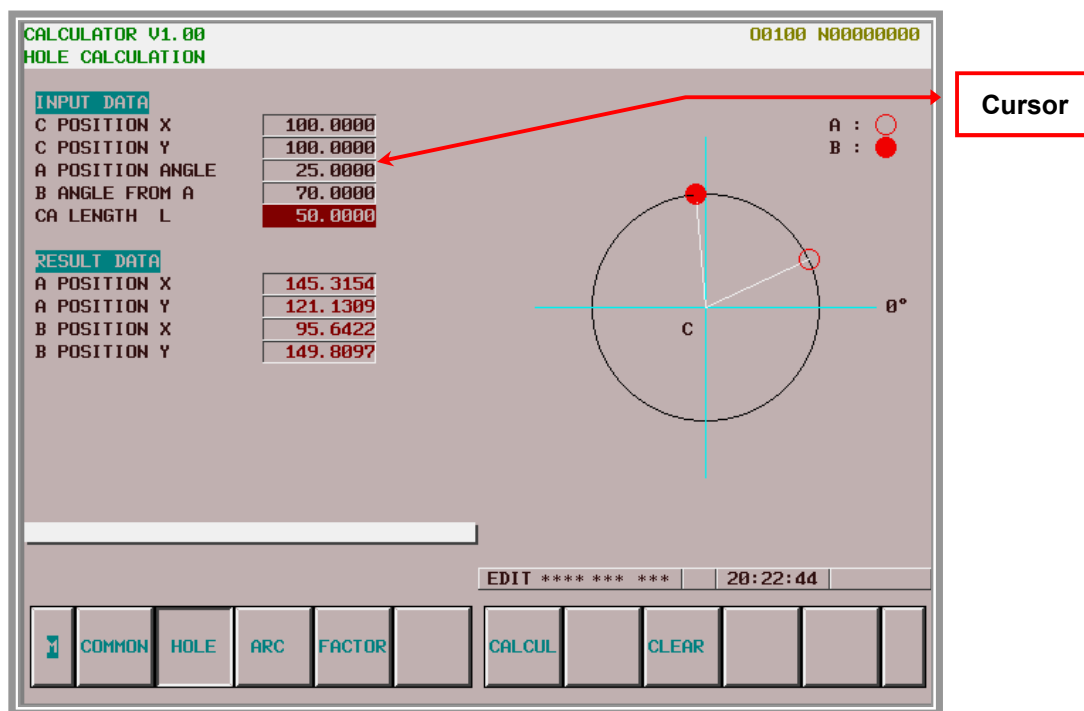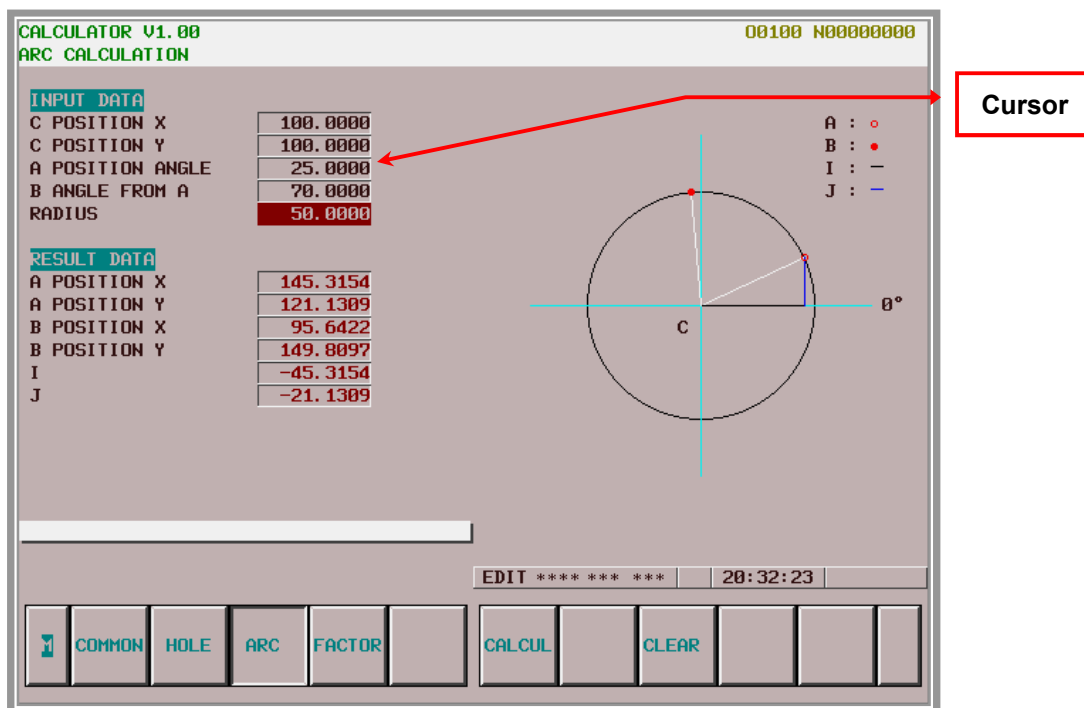
Cursor

5.4 OPERATION

1. When pushing [ARC] Soft Key of calculation menu, the above window is opened.
2. Use cursor key for selecting item of INPUT DATA and then input a value.
3. Refer to the right graphic.
4. Use [CALCUL] Soft Key for displaying calculated result datum.
5. Use [CLEAR] Soft Key for clearing all datum.
6. Use the [M] Soft Key for returning to main menu.

[Factor Calculation]

```
CALCULATOR V1.00                               OO100 N00000000
CUTTING CALCULATION FOR MILLING

INPUT DATA                              GUIDE
CUTTER DIAMETER D      12.7000  mm      1.CAN CALCULATE V DATA IF INPUT D
SURFACE SPEED    V      1.5161  m/min     AND N DATA AND THEN PUSH V-CALC
SPINDLE RPM      N     38.0000            SOFTKEY
FEED PER REV     F      0.0400  mm/rev  2.CAN CALCULATE N DATA IF INPUT D
NOSE RADIUS      R      1.2000  mm        AND V DATA AND THEN PUSH N-CALC
                                          SOFTKEY
RESULT DATA                             3.CAN CALCULATE RMAX DATA IF INPUT
SURFACE SPEED    V      1.5161  m/min      F AND R DATA AND THEN PUSH R-CALC
SPINDLE RPM      N     37.9992            SOFTKEY
ROUGHNESS        Ra     0.1250  um      4.CAN CHANGE CALCULATION UNIT USING
                                          INCH OR MM SOFTKEY
THESE RESULT DATUM ARE FOR REFERENCE    5.CAN CLEAR ALL INPUT AND RESULT
                                          DATA USING CLEAR SOFTKEY



                                        MEM  **** *** ***   |  20:15:01

[M] COMMON  HOLE  ARC  FACTOR         CLEAR  inch  V-CALC N-CALC R-CALC
```

Cursor

5.5 OPERATION

1. When pushing {FACTOR} Soft Key of calculation menu, the above window is opened.
2. Use cursor key for selecting item of INPUT DATA and then input a value.
3. Use {V-CALC} Soft Key for calculating surface speed.
4. Use {N-CALC} Soft Key for calculating spindle RPM.
5. Use {R-CALC} Soft Key for calculating theoretical MAX Roundness Rmax.
6. Use {mm} Soft Key for clearing all datum and converting to window to input as mm unit.
7. Use {inch} Soft Key for clearing all datum and converting to window to input as inch unit.
8. Use {CLEAR} Soft Key for clearing all datum.
9. Use the {M} Soft Key for returning to main menu.

NOTICE

1. These result datum are for reference. Refer to tool maker manual and your experience for calculating exact value.

6. G CODE HELP

```
DOOSAN Easy Operation Package                    O0001 N00000000
 G CODE LIST

   PAGE 1/ 6
   CODE  FUNCTION
   G00    RAPID FEED POSITIONING
   G01    LINEAR INTERPOLATION
   G02    CIRCULAR INTERPOLATION-CW
   G03    CIRCULAR INTERPOLATION-CCW
   G04    DWELL
   G05.4  HRV3 ON OFF
   G07.1  CYLINDRICAL INTERPOLATION
   G08    ADVANCE PREVIEW CONTROL                    ◄───── Cursor
   G09    EXACT STOP
   G10    PROGRAMMABLE DATA INPUT
   G11    PROGRAMMABLE DATA INPUT MODE CANCEL
   G12.1  POLAR COORDINATE INTERPOLATION ON
   G13.1  POLAR COORDINATE INTERPOLATION OFF
   G17    XPYP PLANE SELECTION
   G18    ZPXP PLANE SELECTION


                              EDIT **** *** ***  |  13:52:28

  [M] [G00~] [G19~] [G39~] [G54~] [G71~] [G88~] [ ] [ ] [ ] [ ]
```
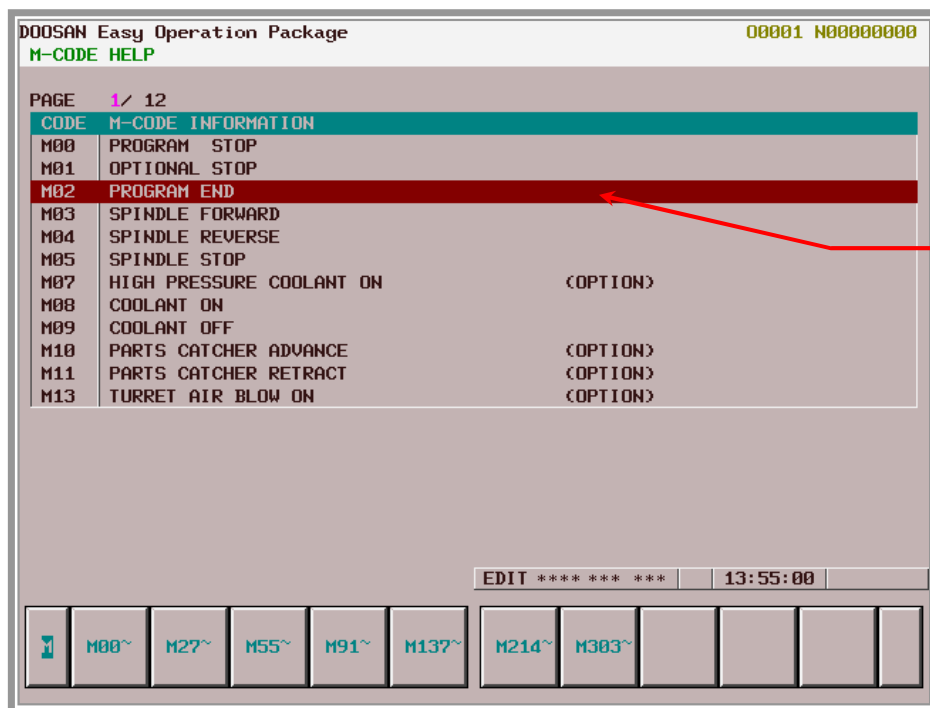
6.1 *OPERATION*

1. When pushing {G-CODE} Soft Key of main menu, the above window is opened.
2. Use the cursor key for selection.
3. Use [PAGE UP] or [PAGE DOWN] key for searching other page.
4. Use the Soft Key for searching written code page.
5. Use the {M} Soft Key for returning to main menu.

NOTICE

1. This is FANUC G cord system. It's different in case of other NC.
2. Because these codes are turning center G codes, so it's different from ones of machining center .

7. M CODE HELP

```
DOOSAN Easy Operation Package                      O0001 N00000000
 M-CODE HELP

PAGE    1/ 12
 CODE   M-CODE INFORMATION
 M00    PROGRAM  STOP
 M01    OPTIONAL STOP
 M02    PROGRAM END
 M03    SPINDLE FORWARD
 M04    SPINDLE REVERSE
 M05    SPINDLE STOP
 M07    HIGH PRESSURE COOLANT ON          (OPTION)
 M08    COOLANT ON
 M09    COOLANT OFF
 M10    PARTS CATCHER ADVANCE             (OPTION)
 M11    PARTS CATCHER RETRACT             (OPTION)
 M13    TURRET AIR BLOW ON                (OPTION)




                              EDIT **** *** ***   | 13:55:00 |

  M    M00~   M27~   M55~   M91~  M137~   M214~  M303~
```

Cursor

7.1 OPERATION

1. When pushing {M-CODE} Soft Key of main menu, the above window is opened.
2. Use the cursor key for selection.
3. Use [PAGE UP] or [PAGE DOWN] key for searching other page.
4. Use the Soft Key for searching written code page.
5. Use the {M} Soft Key for returning to main menu

NOTICE

1. Because of DOOSAN turning center standard code system.
   It's different from ones of machining center.

2. Refer to that these codes can be different from DOOSAN M code changing recently.
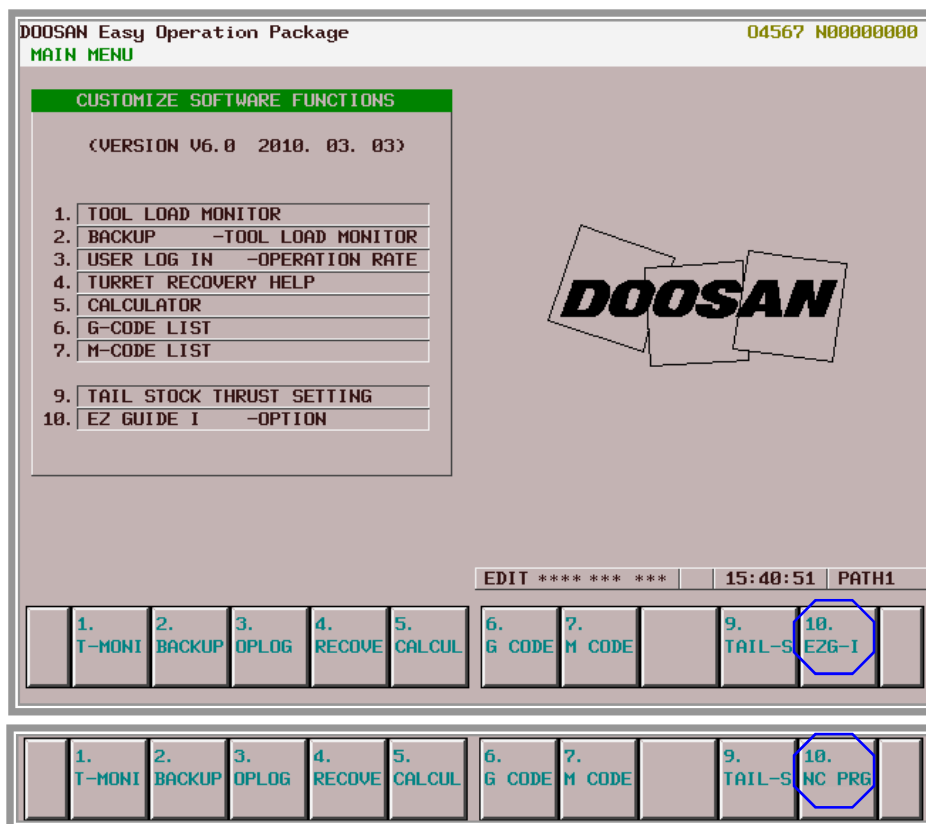
9. Tail Stock Thrust Setting
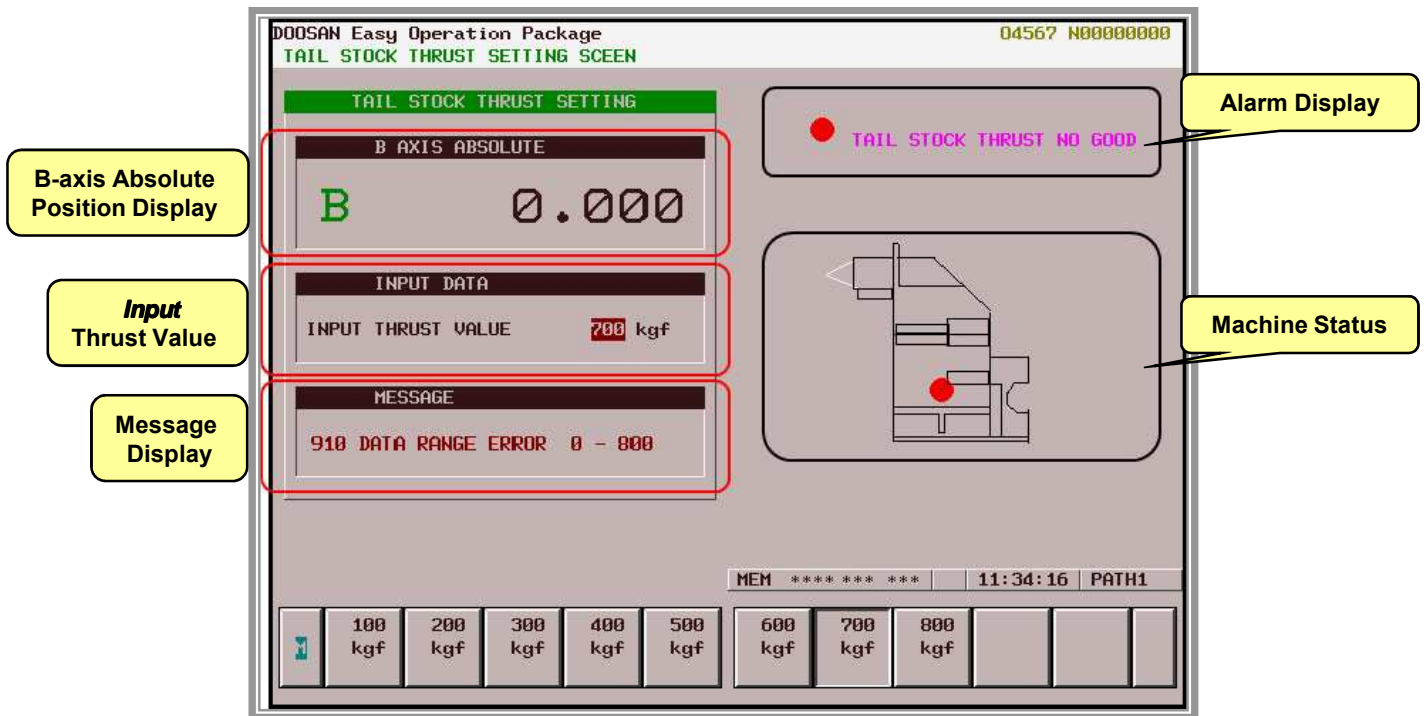
9.1 OPERATION

1. Using the below soft key, You can set the thrust value from 100 to 800kgf.

2. When you use the thrust value which is not supported by the soft key, operator can directly set the desired value using the Key in method.

10. EZ GUIDE I (OPTION)

10.1 OPERATION

1. When mode is common program mode, program window is converted to EZ- GUIDE I

   mode using {EZG-I} Soft Key.

2. When mode is EZ- GUIDE I program mode, program window is converted to common
   mode using {NC PRG} Soft Key

개정 번호	개정 내용	날짜	소프트 버전
R1	Software Version 6.00	2010.04.17	V6.0

E.O.D